(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 July 2004 (08.07.2004)

PCT

(10) International Publication Number
WO 2004/057189 A1

(51) International Patent Classification⁷: F04B 39/12, 39/00

(21) International Application Number: PCT/KR2002/002403

(22) International Filing Date: 20 December 2002 (20.12.2002)

(25) Filing Language: English

(26) Publication Language: English

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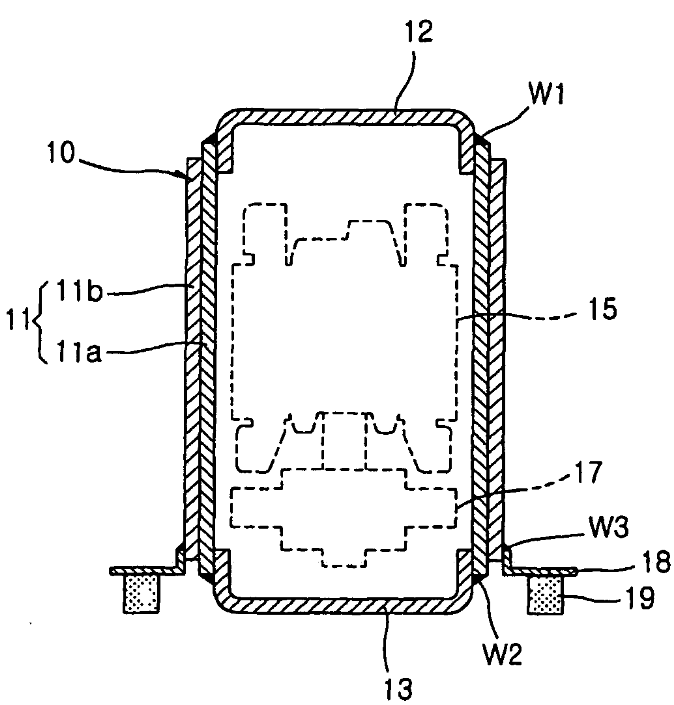
(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) Title: CHAMBER FOR COMPRESSOR AND COMPRESSOR USING THE SAME



(57) Abstract: A chamber (10) for a compressor is disclosed in which at least one portion has a multi-layer structure (11) and plates having the multi-layer structure are tightly attached to thereby reduce noise and vibration by virtue of mutual frictional force. Vibration energy is transformed to thermal energy according to friction and transmitted externally through the chamber (10) during the operation of the compressor. Thus, noise and vibration generated during the operation of the compressor can be considerably reduced.

WO 2004/057189 A1

10/PRTS

10/539309
JC17 Rec'd PCT/PTO 16 JUN 2005

CHAMBER FOR COMPRESSOR AND COMPRESSOR USING THE SAME

TECHNICAL FIELD

The present invention relates to a compressor and, more particularly, to a chamber structure for a compressor that is capable of reducing vibration and noise generated during operation of the compressor.

BACKGROUND ART

In general, compressors convert mechanical energy into compression energy of compressible fluid. In particular, compressors adopted for a refrigeration system are roughly divided into a rotary compressor, a reciprocating compressor, a scroll compressor, or the like.

Figure 1 shows a chamber for the rotary compressor in accordance with a conventional art.

As shown in Figure 1, in a general rotary compressor, as an electric mechanism unit 2 mounted in a chamber 1 operates, a rotor 3 and a rotational shaft 4 are rotated, and at this time, as a compression mechanism unit 5 operates, fluid is sucked into, compressed in and discharged from the cylinder 6.

In other words, as a rolling piston 7 mounted at an eccentric portion 4a of the rotational shaft 4 is rotated along the inner circumferential surface of a cylinder 6, the fluid sucked into a compression space (V) through a suction

opening 6a is compressed and discharged through a discharge passage 6b, and this operation is repeatedly performed.

The chamber 1 of the conventional rotary compressor includes a body 1a formed in a cylindrical structure and having a suction pipe 8 for sucking a fluid penetratingly formed at one side thereof, an upper cap 1b coupled at an upper portion of the body 1a and having a discharge pipe 9 for discharging the fluid, and a lower cap 1c coupled at a lower portion of the body 1a and supported by a certain space.

In particular, as shown in Figure 2, the chamber 1 is constructed in a hermetic type structure having the electric mechanism unit 2 and the compression mechanism unit 5 therein as the body 1a, the upper cap 1b and the lower cap 1b, each having a single layer structure, are fixed to each other through welding.

However, the compressors including the rotary compressor, the reciprocating compressor and the scroll compressor, or the like, have the following problems.

That is, during its operation, pressure pulsation sound and friction sound among mechanism units create vibration and noise, which are externally discharged through the chamber 1 of the compressor. This is a critical factor increasing noise of an outdoor unit of an air-conditioner or a refrigerator.

In an effort to reduce the noise discharged externally of the chamber of the compressor, Japanese Patent Laid Open No. JP04-019373 proposes a configuration that a resin layer is inserted between two sheets of chamber to

block such noise discharged outwardly. But this configuration has a difficulty in its fabrication because the overall thickness of the chamber is increased due to the two sheets of chamber spaced apart and an additional structure inserted into the two sheets, and the resin layer insertion process is additionally performed.

In addition, the resin layer inserted between the two sheets of chamber to serve as sound absorption material is very expensive, resulting in increase in chamber fabrication cost.

DISCLOSURE OF THE INVENTION

Therefore, it is an object of the present invention to provide a chamber for a compressor that is capable of reducing externally discharged vibration and noise generated during operation of the compressor through friction between chamber layers by making the chamber multi-layer structure, and a compressor using the same.

To achieve these objects, there is provided a chamber for a compressor of which at least one portion has a multi-layer structure and plates in the multi-layer structure are tightly attached to thereby reduce noise and vibration by virtue of mutual frictional force.

To achieve these objects, there is also provided a chamber for a compressor including: an inner body and an outer body formed in a cylindrical shape and tightly attached to each other to reduce noise and vibration generated from the inside through mutual friction; an upper cap coupled at an

upper portion of the inner body; and a lower cap coupled at a lower portion of the inner body.

To achieve these objects, there is also provided a compressor including: a chamber having a cylindrical body, an upper cap coupled at an upper portion of the body and a lower cap coupled at a lower portion of the body; an electric mechanism unit positioned inside the chamber and generating a rotational force; and a compression mechanism unit for compressing and discharging fluid by the rotational force generated from the electric mechanism unit in the chamber, wherein the body of the chamber includes an inner body and an outer body which are tightly attached to reduce noise and vibration generated in the chamber through mutual friction.

To achieve these objects, there is also provided a compressor including: a chamber having a cylindrical body, an upper cap coupled at an upper portion of the body and a lower cap coupled at a lower portion of the body; an electric mechanism unit positioned inside the chamber and generating a rotational force; and a compression mechanism unit for compressing and discharging a fluid by the rotational force generated from the electric mechanism unit in the chamber, wherein the body of the chamber includes an inner body and an outer body which are tightly attached to reduce noise and vibration generated in the chamber through their mutual friction, and the inner body is fixed to the upper cap and the lower cap through welding.

The chamber for a compressor in accordance with the present invention has a tightly attached multi-layer structure at at least one portion of the

chamber so that vibration energy transmitted outwardly through the chamber during operation of the compressor is converted into thermal energy and diffused outwardly, and thus, noise and vibration are considerably reduced.

With a compressor having the chamber in accordance with the present invention, noise diffused outwardly can be minimized, so that reliability of the product can be improved and more quiet and agreeable environment can be created.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a vertical-sectional view of a rotary compressor with a chamber in accordance with a conventional art;

Figure 2 is a schematic view showing the rotary compressor of Figure 1;

Figure 3 is a schematic view showing a compressor with a chamber in accordance with the first embodiment of the present invention;

Figure 4 is a sectional view showing noise and vibration reduction principle of the compressor in accordance with the present invention;

Figure 5A shows a hysteresis loop of force-strain in a chamber having two-layer structure of different materials in accordance with the present invention;

Figure 5B shows a hysteresis loop of force-strain in a chamber made of a single material;

Figures 6A and 6B are sectional views showing modifications of the first embodiment of the present invention;

Figures 7A and 7B are a plan view and a sectional view of a body part in a double-layer structure in accordance with the first embodiment of the present invention;

Figures 8A and 8B are a plan view and a sectional view of a body part in a triple-layer structure in accordance with a modification of the first embodiment of the present invention;

Figures 9A and 9B are a plan view and a sectional view of a body part in a quadruple-layer structure in accordance with a modification of the first embodiment of the present invention;

Figure 10 is a schematic view showing a compressor with a chamber in accordance with the second embodiment of the present invention;

Figure 11 is a schematic view showing a compressor with a chamber in accordance with the third embodiment of the present invention;

Figure 12 is a schematic view showing a compressor with a chamber in accordance with the fourth embodiment of the present invention;

Figure 13 is a schematic view showing a compressor with a chamber in accordance with the fifth embodiment of the present invention; and

Figure 14 is a schematic view showing a compressor with a chamber in accordance with the sixth embodiment of the present invention.

MODES FOR CARRYING OUT THE PREFERRED EMBODIMENTS

In explanations of a preferred embodiment of the present invention, a major part of the chamber structure will be described for simplicity purpose. In

this respect, even though a substantial construction is illustrated, it is applied to all of a general rotary compressor, a reciprocating compressor and a scroll compressor.

Figure 3 is a schematic view showing a compressor with a chamber in accordance with the first embodiment of the present invention.

The compressor with a chamber in accordance with the first embodiment of the present invention includes: a hermetic chamber 10, an electric mechanism unit 15 positioned inside the chamber 10 and generating a rotational force; and a compression mechanism unit 17 for compressing and discharging fluid by rotational force generated from the electric mechanism unit 15 in the chamber 10.

The chamber includes a cylindrical body 11, an upper cap 12 coupled at an upper portion of the body 11, a lower cap 13 coupled at a lower portion of the body 11, a support 18 and a damper 19 coupled at a lower portion of the body 11 and supporting the chamber 10.

The body 11 has a double-layer structure, including an inner body 11a and an outer body 11b, so as to reduce noise and vibration generated when the compressor is driven.

The inner body 11a and the outer body 11b are tightly attached each other so that when noise and vibration are generated in and transmitted from the compressor, friction takes place between the first and the second bodies 11a and 11b due to difference in deformation between the bodies 11a and 11b by which the noise and vibration diffused outwardly of the chamber 11 through

the body 1 is reduced.

Referring to assembling of the inner body 11a and the outer body 11b, they can be press-fit to be coupled to each other in a manner that the outer body 11b is fix at the outer side of the inner body 11a so as to have a tight contact structure.

Assembling of the inner body 11a and the outer body 11b is not limited to the press-fit method, and the inner body 11a and the outer body 11b can be attached by a general shrinkage coupling method or by using an attaching member. Otherwise, the two bodies 11a and 11b can be coupled at their outer and inner surfaces and then an inner diameter of the inner body 11a can be extended by using tools such as a jig. In this manner, the inner body 11a and the outer body 11b are tightly coupled to constitute the integrated chamber body 11.

In addition, the inner body 11a and the outer body 11b can be made of different materials, for which the two bodies 11a and 11b are preferred to have different thermal expansion coefficient from each other in order to create a friction energy by virtue of the mutually different deformation.

In such a case, preferably, the outer body 11b is made of a material having a higher thermal expansion coefficient or a modulus of strain than that of the inner body 11a. The reason is because the inner body 11a can be hardly deformed compared to the outer body 11b due to its small curvature radius and a stress is concentrated to the inner body 11a.

The contact surfaces between the inner body 11a and the outer body

11b are preferably formed to be rugged surface so that sufficient frictional force can be formed between the both bodies 11a and 11b and transformed to thermal energy when noise and vibration energy is transmitted from the inside of the chamber 11.

As for the chamber of the present invention, the upper cap 12 and the lower cap 13 are respectively fixed at the inner body 11a through welding W1 and W2, and the support 18 is fixed at the outer body 11b through welding W3. At this time, the outer body 11b is formed shorter than the inner body 11a so that the outer body 11b may not be welded when the inner body 11a, the upper cap 12 and the lower cap 13 are welded.

The principle of reducing noise and vibration of the multi-layer chamber will now be described with reference to Figures 4, 5A and 5B.

Figure 4 is a sectional view showing a finite element of the double-structured chamber.

With reference to the hysteresis loop of Figure 5A, in a state that a lower plate 111b and an upper plate 111a are mutually coupled with strong contact force and on the assumption that the lower plate 111b is fixed, when force (Fg) as shown in Figure 4 is applied to the upper plate 111a, the upper plate 111a undergoes elastic deformation and then a plastic deformation. Thereafter, if the force stronger than the contact force between the upper plate 111a and the lower plate 111b is applied to the upper plate 111a, coulomb friction occurs between the upper plate 111a and the lower plate 111b. Then, the upper plate 111a makes a sliding motion on the lower plate 111b to generate heat J.

At this time, sound and vibration absorption operations are performed by the friction energy, that is, the thermal energy, generated between the upper plate 111a and the lower plate 111b, thus absorbing the vibration energy that may be diffused outwardly of the chamber.

Figure 5B illustrates a hysteresis loop showing load change when tensile compression is applied to general steel.

Various embodiments of the chamber structure with the above-described noise and vibration reduction principle in accordance with the present invention will now be described.

Figure 6A is a modification of the first embodiment of the present invention, in which an inner body 11a' and an outer body 11b' of the body 11' have the same length.

In addition, the inner body 11a' and the outer body 11b' have different thickness (t1 and t2). In this respect, preferably, the thickness t2 of the outer body 11b' is thinner than the thickness t1 of the inner body 11a' so that a strain of the outer body 11b' can be greater than that of the inner body 11'.

Figure 6B illustrates another modification of the first embodiment, in which the inner body 11a' and the outer body 11b' are formed to have the same length and the lower portions of the inner body 11a' and the outer body 11b' are fixed together at the lower cap 13 through welding W2'.

At this time, the upper portions of the inner body 11a' and the outer body 11b' may be fixed by welding, but they are preferably not welded in consideration of deformation of the inner body 11a' and the outer body 11b'.

Accordingly, at the upper end portion of the body 11', the inner body 11a' is welded W1 to the upper cap 12, and at the lower end portion of the body 11', the outer body 11b' is welded W2 to the lower cap 13. As a matter of course, the support 19 is fixed at the outer body 11' by welding W3.

Figures 7A and 7B are a plan view and a sectional view showing the double-layer structure body parts, in which, the body 11 includes the inner body 11a and the outer body 11b which are tightly coupled to each other.

Figures 8A and 8B show a different modification of the first embodiment of the present invention, showing a body 21 including an inner body 22, an outer body 23 and a middle body 24 inserted between the inner body 22 and the outer body 23.

The middle body 24 is tightly attached at both surfaces to the inner body 22 and the outer body 23.

The inner body 22, the middle body 24 and the outer body 23 can be made of different materials so that each thermal expansion coefficient can be different from each other. In this case, preferably, the size of the thermal expansion coefficient may increase sequentially in order of the inner body 22, the middle body 24 and the outer body 23.

Figures 9A and 9B illustrate a modification of the first embodiment of the present invention, showing a quadruple-layer structure body 31, in which two middle bodies 34 and 35 are inserted between the inner body 32 and the outer body 33.

Likewise in the first embodiment as described above, those bodies 32,

33, 34 and 35 are tightly attached to each other.

Figure 10 is a schematic view showing a compressor with a chamber in accordance with the second embodiment of the present invention.

The chamber of the first embodiment shows a multi-layer structure body, while a chamber 40 of the second embodiment of the present invention shows a construction that chamber 40 is entirely formed in a multi-layer structure.

That is, the chamber 40 of the second embodiment includes inner chambers 41a, 42a and 43a and outer chambers 41b, 42b and 43b, so that noise and vibration generated in the chamber 40 can be reduced through mutual friction between the inner chambers 41a, 42a and 43a and the outer chambers 41b, 42b and 43b.

Accordingly, all of the body 41, the upper cap 42 and the lower cap 43 of the chamber 40 have a double-layer structure.

In assembling of the inner chambers 41a, 42a and 43a and the outer chambers 41b, 42b and 43b, the body 41, the upper cap 42 and the lower cap 43 are fabricated in the double-layer structure and mutually assembled.

Though Figure 10 illustrates the chamber 40 in the double-layer structure, the chamber can be configured to have a triple-layer structure or a quadruple-layer structure as illustrated in Figures 8A and 9A.

Figure 11 illustrates that only an upper cap 52 of a chamber 50 is formed in a double-layer structure, Figure 12 illustrates that only a lower cap 63 of a chamber 60 is formed in a double-layer structure, and Figure 13 illustrates that an upper cap 72 and a lower cap 73 of a chamber 70 are formed in a

double-layer structure.

As shown in Figures 11 to 13, in the case that the upper cap or the lower cap has the double-layer structure, they can be tightly attached through such methods of press-fit, shrinkage, inner diameter enlargement as in the first embodiment. The upper cap or the lower cap can be formed in a triple-layer structure or in a quadruple-layer structure as necessary.

Preferably, a typical heat-releasing structure is secured at the outside of the upper cap and the lower cap so as to outwardly releasing heat smoothly the thermal energy resulting from the friction generated during the operation of the compressor.

Though not shown in the drawings, the body and the upper cap, or the body and the lower cap of the chamber may have a multi-structure.

Figure 14 is a schematic view showing a compressor with a chamber in accordance with the sixth embodiment of the present invention.

In order to diffuse outwardly the thermal energy of the chamber generated between an inner body 81a and an outer body 81b, heat releasing unit is installed at an outer side of the outer body 81b.

As the heat releasing unit, a plurality of fin plates 84 are formed to be protruded outwardly from the outer body 81b to diffuse heat. Otherwise, the heat releasing unit can be a metal plate (not shown) made of material having high thermal conductivity, which is tightly attached to the outer body 81b and transmits heat outwardly.

As so far described, the chamber for a compressor in accordance with

the present invention has the following advantages.

That is, with at least one portion formed in a multi-layer structure, the vibration energy is transformed to thermal energy according to friction and transmitted externally through the chamber during the operation of the compressor. Thus, noise and vibration generated during the operation of the compressor can be considerably reduced.

In addition, when the compressor with the chamber in accordance with the present invention is adopted to a refrigerator or an air-conditioner using a refrigeration cycle formed by a compressor, an condenser, an expansion valve and an evaporator, the noise generation of the compressor, the main noise source when the refrigerator or the air-conditioner operates, is minimized. Thus, a reliability of the product can be improved and an agreeable environment can be provided.

It will be apparent to those skilled in the art that various modifications and variations can be made in the chamber for a compressor of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

CLAIMS

1. A compressor comprising:

a chamber consisting of a cylindrical body, an upper cap coupled at an upper portion of the body and a lower cap coupled at a lower portion of the body;

an electric mechanism unit positioned inside the chamber and generating rotational force; and

a compression mechanism unit for compressing and discharging fluid by the rotational force generated from the electric mechanism unit in the chamber,

wherein the body of the chamber includes an inner body and an outer body which are tightly attached to reduce noise and vibration generated in the chamber through mutual friction between the inner body and the outer body.

2. The compressor of claim 1, wherein a middle body is interposed between the inner body and the outer body.

3. The compressor of claim 2, wherein the bodies are assembled in a manner of being press-fit to other body.

4. The compressor of claim 1, wherein the inner body and the outer body are assembled by being mutually press-fit.

5. The compressor of claim 1, wherein the inner body and the outer body are assembled by being shrunken to each other.

6. The compressor of claim 1, wherein the inner body and the outer body are mutually welded at at least one portion thereof.

7. A compressor comprising:

a chamber consisting of a cylindrical body, an upper cap coupled at an upper portion of the body and a lower cap coupled at a lower portion of the body;

an electric mechanism unit positioned inside the chamber and generating rotational force; and

a compression mechanism unit for compressing and discharging fluid by the rotational force generated from the electric mechanism unit in the chamber,

wherein the body of the chamber includes an inner body and an outer body which are tightly attached to reduce noise and vibration generated in the chamber through their mutual friction, and the inner body is fixed to the upper cap and to the lower cap through welding.

8. The compressor of claim 7, wherein the inner body and the outer body are attached at one portion thereof through welding.

9. The compressor of claim 7, wherein the inner body and the outer

body are assembled by being press-fit.

10. The compressor of claim 7, wherein the inner body and the outer body are assembled by being shrunken to each other.

11. A chamber for a compressor, comprising a multi-layer structure at at least one portion, wherein plates of the multi-layer structure are tightly attached to each other in order to reduce noise and vibration by mutual friction.

12. The chamber of claim 11, comprising a cylindrical body, an upper cap coupled to an upper portion of the body and a lower cap coupled to a lower portion of the body, wherein the body has a multi-layer structure.

13. The chamber of claim 12, wherein the body has a double-layer structure.

14. The chamber of claim 11, comprising a cylindrical body, an upper cap coupled to an upper portion of the body and a lower cap coupled to a lower portion of the body, wherein one of the upper cap and the lower cap has a multi-layer structure.

15. The chamber of claim 11, having a double-layer structure or a triple-layer structure at at least one portion thereof.

16. The chamber of claim 11, wherein the portions in the multi-layer structure are assembled by being press-fit.

17. The chamber of claim 11, wherein the portions in the multi-layer structure are assembled by being shrunken to each other.

18. The chamber of claim 11, wherein the portions in the multi-layer structure are assembled by being attached to each other.

19. The chamber of claim 11, wherein one layer and its adjacent layer are made of different materials.

20. The chamber of claim 19, wherein one layer and its adjacent layer are made of materials with different thermal expansion coefficient.

21. The chamber of claim 20, wherein the layer positioned at outer side of a compressor is made of material having higher thermal expansion coefficient than that of the layer positioned at an inner side of the compressor.

22. The chamber of claim 11, wherein one layer and another layer attached thereto have different moduli of strain.

23. The chamber of claim 22, wherein the layer positioned at an outer side of the compressor is made of material having higher modulus of strain that that of the layer positioned at an inner side of the compressor.

24. The chamber of claim 11, wherein each layer constituting the multi-layer structure has different thickness.

25. The chamber of claim 24, wherein the layer positioned at the inner side of the chamber is thicker than the layer positioned at the outer side of the chamber.

26. The chamber of claim 11, wherein the mutually contacting surfaces of the portions in the multi-layer structure formed to be rugged.

27. The chamber of claim 11, wherein a heat releasing unit is provided at the outer layer in the multi-layer structure of the chamber.

28. The chamber of claim 27, wherein the heat releasing unit includes a plurality of fin plates.

29. The chamber of claim 27, wherein the heat releasing unit is a metal plate being in contact with the outer layer constituting the chamber.

30. A chamber for a compressor comprising:

a cylindrical inner body and a cylindrical outer body which are tightly attached to reduce noise and vibration generated inside through mutual friction;

an upper cap coupled to an upper portion of the inner body; and

a lower cap coupled to a lower portion of the inner body.

31. The chamber of claim 30, further comprising a support coupled to the outer body and supporting the chamber.

32. The chamber 31, wherein the support is fixed at the outer body through welding.

33. The chamber of claim 30, wherein the upper cap and the lower cap are fixed at the inner body through welding.

34. The chamber of claim 30, wherein the outer body is formed shorter than the overall length of the inner body.